

DARPA-BAA-11-09: Near Junction Thermal Transport FAQ Updated February 24, 2011

Q27: If our proposed approach involves a new feature that doesn't exist in our existing design, such as, for instance, a backside channel in the SiC for an active liquid cooling design, then we would necessarily have to design a mask to implement such features in the SiC backside and include this in our cost proposal, is this correct?

A27: It is expected that all proposed thermal management improvements included in the proposed design would appear in the cost proposal.

Q26: The BAA specifies that the SOW should be 2 pages, but it also includes the sentence: "The page length for the SOW will be dependent on the amount of the effort." Can you provide clarification on what this means? Can we go over the 2-page limit? Will that count/not-count as part of the page count of the other BAA sections?

A26: Two pages are the limit for this section.

Q25: At page 22 of the BAA, "summary slides" have been mentioned. Please clarify where we should include the summary slides. Is there a template to follow?

A25: This is a typo. Summary slides are not required for this BAA submission; therefore there is no template available.

Q24: Given that we need to demonstrate a 3x increase in RF power density in this phase of the program, and the proposed approach involves increasing the pitch of the device, which may be different than the existing baseline device, does that imply that we would need to create a new mask with this new proposed layout? If we are not expected to create such a new layout in this phase of the program, how would one go about validating such an expected increase – would it be based on measurements of temperature/thermal resistance on the existing baseline layout and extrapolation/projection based on comparison of measured thermal parameters using the simulation as a guide to this projection?

A24: The BAA does not imply the need to create new masks. As stated on Page 6 of the BAA, "Existing GaN MMIC PA designs will be considered as test vehicles provided their thermal performance can be convincingly verified." It is the responsibility of the proposer to determine their specific test vehicle and procedure for performance verification and it is expected that performance increases would be validated through a combination of demonstrations and modeling.

Q23: Under Section I. Administrative C. outlines that the Cost Proposal Summary Checklist be included in the Technical and Management Proposal (after the official transmittal letter). However, the form itself states that "This worksheet must be included with the coversheet of the Cost Proposal". Could you please confirm that you want this form (3 pages) in the Technical Volume per the BAA or in the after the coversheet of the cost proposal (or in both locations)?

A23: Please include the cost proposal checklist to the end of the cost proposal.

Q22: I would like to request some clarification regarding the test structures to be used for these proposals. 1) Will DARPA be providing test structures? 2) Would these test structures be wafers or devices? 3) What details (if any) can be provided regarding the test structures in order for us (and partners we are looking to work with) can better estimate the costs for the project?

A22: DARPA will not provide test structures. It is the responsibility of the proposer to determine their specific test vehicle and procedure and its estimated cost.

Q21: Is the application of a low magnetic field (order of 100 Gauss) with slow temporal variation (10 Hz) considered detrimental for the operation of the specific power amplifier of relevance to this BAA?

A21: It is the responsibility of the proposer to demonstrate in the proposal that the technical approach would not be detrimental to the operation of the relevant power amplifier.

Q20: We plan to submit our proposal via Grants.gov. In addition to completing the cost volume according to your instructions, should we also complete the budget form in Grants.gov?

A20: Yes, proposers submitting via grants.gov should also complete the budget form in grants.gov.

Q19: Are we allowed to use the Grants.gov Senior Personnel form to attach biographical sketches of the key personnel? If so, are there page or formatting restrictions on the biographical sketches?

A19: Yes, you are permitted to use the Senior Personnel form, but it is preferred that you include PDF documents at the end of your proposal.

Q18: Should proposers use the same username and password for the full proposal that was used when submitting the abstract? or should I setup a new account?

A18: Please setup a new account in TFIMS for your full proposal submission.

Q17: In the BAA on page 7, it says that "DARPA is interested in thermal management approaches that will allow GaN PAs to operate in existing State of the Art DoD systems with significant increases in power handling (3x) and without accompanying increases in the temperature difference from the junction to the base of the heat sink or cold plate." How thorough of a thermal analysis of the entire system should a proposal cover given that the focus of this BAA is near junction thermal transport?

A17: As stated on page 6 of the BAA: "DARPA expects proposers to define, explore, and demonstrate thermal management approaches that can substantially reduce or remove the thermal barriers to high-power operation of GaN PAs and similar components and to provide convincing evidence of the performance improvements that will results from the implementation of such NJTT techniques." DARPA expects "providing convincing evidence" to include detailed thermal models and accompanying simulations of the proposed technical approach for the near junction thermal management. These models and accompanying simulations should quantitatively describe how the heat is removed near the junction and how it is transported across any intervening layers and interfaces to the wetted surface of the cold plate or heat sink.. Approaches should clearly address how the coldplate/heat sink will handle

the additional flux resulting from improved near junction thermal transport. DARPA is not interested in moving the thermal problem from the near junction to the coldplate.

Q16: In the BAA, on page 7, it says that “Approaches for improvements to thermal transport in these PAs must not interfere with the present operation of the PA. For example, materials or structures positioned above, below, or around the PA should not compromise the electrical characteristics of the device”. Since any approach will involve some changes to a current device, how much detail about the electrical performance of the new device is required?

A16: As stated in the Advice to Proposers section on page 8 of the BAA: “To the extent possible, a proposal should describe a specific design that will meet the goals in quantitative detail, including the dimensions, materials and all design choices clearly articulated. The modeling tools used to guide the design choices and used to support the anticipated performance characteristics and/or limits should also be described.” Thus as part of any description of the electrical performance of the proposed NJTT device, DARPA would expect that proposers would provide a detailed model of the RF performance of the device and relevant simulations with quantitative performance results to support the electrical characteristics of the device. DARPA is specifically not interested in technical approaches that would lead to RF interference and compromise the performance of the GaN power amplifier. DARPA expects that proposers would provide details on the performance limitations and architecture of their proposed NJTT concept.

Q15: On page 7 of the BAA, it says that “DARPA is primarily interested in thermal management approaches that will allow GaN PAs to operate in existing state of the art DoD systems with significant increases in power handling (>3x). How should proposers describe how they will accomplish this?

A15: As part of the description of the performance improvement, proposers should describe the overall net performance gain including the 3x or greater increase in power handling as stated in the BAA. To do this DARPA expects that proposers will describe the P_{out} , bias condition, operating frequency, and PAE (or P_{in}) of their baseline device (before) and of the baseline + NJTT (after) device in order to evaluate the technical process.

Q14: On page 7 of the BAA, it says that “DARPA is primarily interested in approaches and techniques that can be introduced within conventional GaN on SiC manufacturing processes and using the same manufacturing tools”. Given that any approach will involve at least minor changes to the fabrication process how much detail should be provided?

A14: As stated on page 7 of the BAA: “It is anticipated that new materials and structures may be part of proposed technical approaches; however, successful proposals will describe how these new elements can be introduced within existing manufacturing processes, or describe the manufacturing process additions that will be required.” As part of this description, proposals would be expected to address the viability, reproducibility, and yield of their current GaN baseline process and the expected impact of the proposed NJTT technique on this established process.

Q13: On page 6 of the BAA, the first paragraph of the NJTT Program Scope section states that 'The NJTT program will not provide funding for MMIC design and fabrication cycles unique to this

project...'. If a proposed approach includes pulling a wafer out of a conventional fabrication run, so that alternate processing steps for improved near junction cooling could be applied, and the wafer is then returned to the conventional fabrication run, would that be considered a unique fabrication cycle? In other words, must technologies such as those described on page 7 of the BAA (active liquid cooling, high thermal conductivity substrate, thermal vias, conduction layers, thermoelectrics, overlayers, cryogenic fingers, etc.) be incorporated only on standard wafers or devices that have been completed using only conventional fabrication processes? Or can they be created by adding steps into a conventional wafer fabrication cycle?

A13: The resources in the project should clearly support the steps necessary to implement the thermal approach in the proposed test structure rather than to support multiple amplifier design and fabrication cycles.

Q12: The phrase "Technical Area" is mentioned several times in the solicitation "DARPA-BAA-11-09". What does the phrase mean?

A12: A technical area is unique approach offered by the proposer attempting to meet the BAA goals and objectives.

Q11: I am attempting to log on to the TFIMS website to request an account, however, the site is not connecting. Are others having this same issue and do you have any recommendations?

A11: DARPA has been informed that the TFIMS site is down and is not currently functioning properly. Please retry to connect to the site periodically. If TFIMS is not up and running within 3 business days of the abstract submission due date an amendment to the BAA will be posted with alternative instructions for abstract submission.

Q10: What amount of funding does the government intends to provide each contract under the Phase I effort for the subject BAA?

A10: The Government has established no notional/estimated award amounts.

Q9: Are multiple awards anticipated, if so how many?

A9: The number of awards will be based on the quality of the proposals received and funding availability.

Q8: The BAA generally refers to GaN except for one location where GaN on SiC is specifically mentioned (Page 7). Is this BAA open for solutions which might only apply to GaN on Si devices?

A8: The BAA does not exclude GaN on Silicon and responses based on Near-Junction Thermal Transport techniques relevant only to GaN on Silicon will be considered responsive.

Q7: Could you please let me know whether it would be possible to subcontract a portion of the project to a foreign academic institution? Is there a general DARPA policy on this issue?

A7: The BAA establishes no restrictions which would prevent foreign entities from proposing to this BAA either as a prime or subcontractor.

Q6: Can you please clarify if a team of proposers from multiple universities need to submit one proposal abstract by the lead institution or if each investigator from each institution needs to submit a proposal abstract?

A6: The lead institution is expected to submit one proposal abstract for the entire team. The abstract should include a clearly defined organization chart for the program team which includes, as applicable: (1) the programmatic relationship of team member; (2) the unique capabilities of team members; (3) the task of responsibilities of team members; (4) the teaming strategy among the team members; and (5) the key personnel along with the amount of effort to be expended by each person during each year. See page 18 for detailed instructions.

Q5: Is TFIMS available for abstract submissions?

A5: TFIMS is the required method of submission for all abstracts. See page 14 for detailed instructions.

Q4: Is TFIMS the preferred method for submissions?

A4: TFIMS is the required method for submission of all proposals except those requesting an assistance instrument (grant or cooperative agreement). Submission of proposals requesting award of an assistance instrument must be submitted either electronically via grants.gov or in hardcopy.

Q3. How important is the Cost Proposal?

A3. Very. Please do not submit a poorly constructed cost proposal. A well prepared cost proposal (as described in Section IV, "Volume II, Cost Proposal") will: (a) follow the checklist provided in Attachment 1 Cost-Proposal Checklist, (b) clearly break down costs by Technical Area, task (correlated with the Statement of Work), phase, fiscal year and (c) justify all expenses with price quotes for individual items associated with tasks, travel, staffing, etc. Please note, new equipment purchases will not be approved if the laboratory already owns equipment (or can share with another laboratory) that can function to fulfill the task. Please take the time to check for math errors and inconsistencies, they will reflect very poorly upon your proposal. We suggest that you read through your cost volume as if you were a non-technical government contract specialist performing their due diligence on behalf of the taxpayer, to identify the specific costs of each and every individual task for each and every technical area.

Q2. What is entailed in a PI Meeting?

A2. Section VI of BAA 11-06, "Meeting and Travel Requirements" describes PI Meetings. Briefly, PIs are expected to meet with the Program Manager and the other PIs awarded under this program. This will occur roughly twice a year in a closed meeting. It is expected that PIs will freely share their research results with each other and the Program Manager. The Program Manager would like to instill a "team spirit" among all of the performers in this program, such that the overall goals will be achieved.

Q1. How much money should I ask for?

A1. As much as it takes to achieve the objectives you describe in your proposal. If DARPA were to list a cap of \$X, then most proposals would request \$X-1. Your cost should be based primarily upon how much money is required to perform the research you feel is necessary to meet the objectives in the Technical Areas described in Section 1 of BAA 11-09. Please bear in mind, however, that in this case DARPA prefers to fund multiple independent efforts instead of one single large effort. Proposals must be fiscally conservative and will be scrutinized for unnecessary or inflated expenses. Take great care to demonstrate that the funding you request is the minimum amount needed to achieve the innovations described in the proposal.

If your proposal is selected to be awarded, then a government contract office will negotiate the terms of the grant or contract. During this negotiation phase, every aspect of your statement of work and cost proposal (as described in Section IV of BAA 11-09, "Volume II, Cost Proposal") will be negotiated. Please ensure that you have followed all of the instructions in BAA 11-09, including the required checklist in Attachment 1. This will enable the government contract office to expedite negotiations.